

# Using tracker for jet energy correction

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## Proposed procedure (first simplified version)



Minbias events are generated with PYTHIA with parameters using in fall production 2000.

First simplification: only jet particles in cone 0.5 on generator level are propagated through cmsim.



In order to define charged particles interacted in ECAL Cluster is built in 3x3 crystals around entry point for each charged particle reached ECAL.

Second simplification: No track reconstruction.

For each charged particle Dan Green's procedure to find  $e/\pi(\text{ECAL})$  and  $e/\pi(\text{HCAL})$  is used.

$$e/\pi(\text{ECAL}) = e/h(\text{ECAL}) / (1 + (e/h(\text{ECAL}) - 1) * F0\_ECAL)$$

$$e/\pi(\text{HCAL}) = e/h(\text{HCAL}) / (1 + (e/h(\text{HCAL}) - 1) * F0\_HCAL)$$

$$F0\_ECAL = 0.11 * \log(E\_ECAL)$$

$$F0\_HCAL = 0.11 * \log(E\_HCAL)$$

$E\_ECAL$ ,  $E\_HCAL$  – energy deposited in ECAL, HCAL

*How deposited energy  $E_{ECAL}$ ,  $E_{HCAL}$  are evaluated:*

Particle interacted in ECAL

$$E_{ECAL} = 0.4 * E_{tracker} \text{ (test beam, talk of J.Freeman)}$$

$$E_{HCAL} = 0.6 * E_{tracker}$$

Particle does not interact in ECAL

$$E_{ECAL} = E_{MIP} \text{ (energy from EM cluster)}$$

$$E_{HCAL} = E_{tracker} - E_{MIP}$$

*Response from charged particles is calculated.*

Particle interacted in ECAL

$$R_{ECAL} = E_{ECAL} / (e/\pi)(ECAL)$$

$$R_{HCAL} = E_{HCAL} / (e/\pi)(HCAL)$$

Particle does not interact in ECAL

$$R_{ECAL} = E_{MIP}$$

$$R_{HCAL} = E_{HCAL} / (e/\pi)(HCAL)$$

# Calculation of jet energy.

Energy ( $E_{\text{init}}(\text{ECAL})$ ,  $E_{\text{init}}(\text{HCAL})$ ) is calculated in cone using standard procedure and with default coefficients

Summarized response from charged particles with entry point inside a cone is subtracted from  $E_{\text{init}}(\text{ECAL})$ ,  $E_{\text{init}}(\text{HCAL})$

$$E_{\text{EM+neutral}}(\text{ECAL}) = E_{\text{init}}(\text{ECAL}) - \text{sum}(\text{R\_ECAL\_i})$$

$$E_{\text{neutral}}(\text{HCAL}) = E_{\text{init}}(\text{HCAL}) - \text{sum}(\text{R\_HCAL\_i})$$

$$E_{\text{jet}} = E_{\text{EM+neutral}}(\text{ECAL}) + E_{\text{neutral}}(\text{HCAL}) + E_{\text{tracker}}$$

$$E_{\text{tracker}} = \text{sum}(E_{\text{tracker\_i}})$$

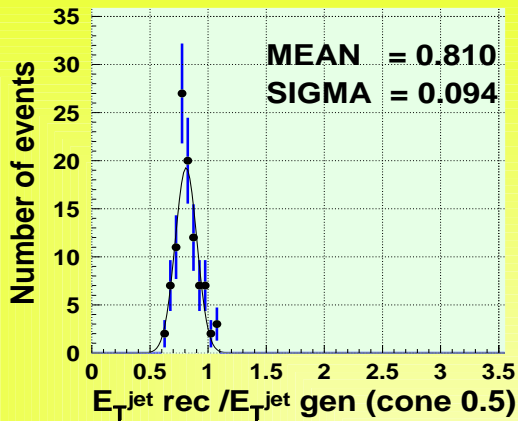
From test-beam results:

$$e/h(\text{ECAL}) = 1.6$$

$$e/h(\text{HCAL}) = 1.39$$

$$E_{\text{ECAL}} = 0.4 E_{\text{tracker}} \text{ for each particle}$$

*For 100 GeV jet:*

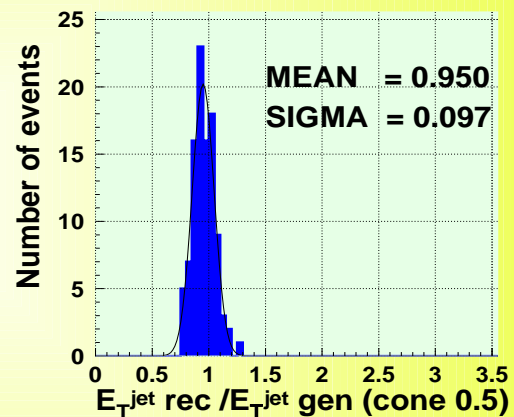


*Standard window algorithm*

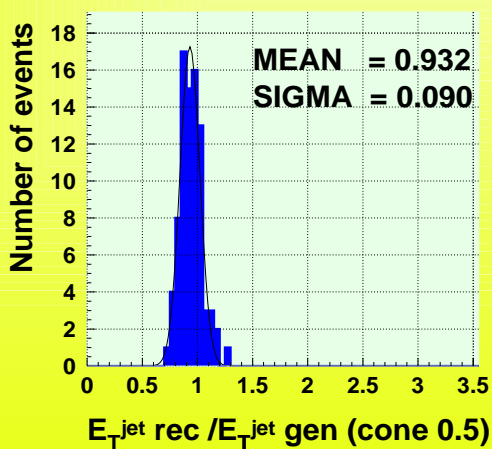
Mean=0.81 $\pm$ 0.011  
sigma=0.094 $\pm$ 0.012  
Resolution=11.6% $\pm$ 1.5%

*It is known if track is  
interacted in ECAL*

Mean=0.95 $\pm$ 0.011  
sigma=0.097 $\pm$ 0.01  
Resolution=10.2% $\pm$ 1%



*Use 3x3 crystall to  
recognize if track is  
interacted*



Mean=0.93 $\pm$ 0.011  
sigma=0.09 $\pm$ 0.009  
Resolution=9.6% $\pm$ 1%

## *What should be changed in nearest future:*

For energy deposition sharing between ECAL and HCAL one should take a curve instead of fixed value 0.4:0.6

e/h for ECAL and HCAL was calculated for HCAL calibrated on electrons and in CMSIM it is calibrated to the 50 GeV pions.

Subtraction of particles response from jet response in cone should depend on the distance between cone boundary and particle entry point.

## *Summary*

Using tracker information allows to increase mean detected energy of jet and at the same way keep dispersion. This allows to improve essential a linearity. Resolution becomes better for about 1.5%.